

## 2.0 HAZARDOUS AIR POLLUTANT SIGNIFICANCE THRESHOLDS

### 2.1 Chronic Exposure Thresholds

Chronic inhalation exposure thresholds for each of the six toxins being analyzed are listed in Table 2.1. The thresholds for n-hexane, toluene, and ethylbenzene listed in Table 2.1 are reference concentrations, defined by EPA as "estimate[s] (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious noncancer effects during a lifetime" (<http://www.epa.gov/ngispgm3/iris/glossary.htm>). Because no analogous data are available from EPA for benzene, formaldehyde, and xylenes, reference exposure levels (RELs) established in the California Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines are presented in Table 2.1 as chronic exposure thresholds (<http://www.arb.ca.gov/toxics/tac/toctbl.htm>). According to the California Air Resources Board (<http://www.arb.ca.gov/toxics/tac/appendxc.htm>), a "REL is a concentration level...at (or below) which no adverse health effects are anticipated for a specified time period." These thresholds are generally applicable to the most sensitive individuals in the population. The maximum predicted annual pollutant concentrations resulting from emissions from the Pinedale Anticline Project wellfield are compared with chronic exposure thresholds for determination of significance.

TABLE 2.1  
CHRONIC EXPOSURE THRESHOLDS

Hazardous Air Pollutant	Threshold ( $\mu\text{g}/\text{m}^3$ )
N-hexane	200 <sup>†</sup>
Benzene	71 <sup>‡</sup>
Toluene	400 <sup>†</sup>
Ethylbenzene	1,000 <sup>†</sup>
Xylene	300 <sup>‡</sup>
Formaldehyde	3.6 <sup>‡</sup>

<sup>†</sup> Accessed from the EPA Integrated Risk Information System website (<http://www.epa.gov/ngispgm3/iris/index.html>).

<sup>‡</sup> California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines.

## 2.2 Significance Thresholds for Cancer Risk

Benzene and formaldehyde are also being analyzed for carcinogenic effects. For these toxins, the cancer risk from inhalation is evaluated and significant impact is defined as a lifetime incremental cancer risk greater than  $1 \times 10^{-6}$  (i.e., interpreted as one additional person out of one million people developing cancer as a result of the exposure to emissions of the pollutant under evaluation from the Pinedale Anticline Project).

The cancer risk is evaluated for two scenarios: a maximum exposure scenario and a most likely exposure scenario. The maximum exposure scenario involves evaluating the increased cancer risk for the maximally exposed individual (i.e., continuous exposure at maximum concentrations for the lifetime of the well(s)). The most likely exposure scenario involves evaluating the cancer risk for an individual with a more reasonable set of exposure assumptions (i.e., intermittent exposure at maximum concentrations for a fraction of the expected lifetime of the well(s)). (Appendix A contains a more detailed explanation of the two scenarios.)

Table 2.2 presents the significance thresholds for each pollutant that correspond with the incremental cancer risk of  $1 \times 10^{-6}$ . The thresholds are calculated using pollutant-specific unit risk factors (defined as the cancer risk expected to result from prolonged exposure to  $1 \mu\text{g}/\text{m}^3$  of the specified pollutant) and adjustment factors calculated based on scenario assumptions, such as length and intensity of exposure. (Attachment A outlines the detailed calculation of these thresholds.) Note that the significance thresholds for cancer risk are more stringent than the chronic exposure thresholds for these two pollutants presented in Section 2.1.

TABLE 2.2  
SIGNIFICANCE THRESHOLDS FOR CANCER RISK

Hazardous Air Pollutant	Maximum Exposure Scenario - Threshold ( $\mu\text{g}/\text{m}^3$ )*	Most Likely Exposure Scenario - Threshold ( $\mu\text{g}/\text{m}^3$ )*
Benzene	0.23	1.28
Formaldehyde	0.18	0.82

\* These thresholds translate to a lifetime incremental cancer risk of  $1 \times 10^{-6}$  (See Attachment A for calculation.)